

Demos / Discussion

- Crush can demo
- What crushes the cans?
- Marshmallow demo
- Why does the marshmallow blow up in a vacuum?
- Why does the bell jar stick to the base?
- Glass of water demo
- Why does the water stay in the glass?

Lesson #49

1/22/07

Topic: Atmospheric Pressure

Objectives: (After this class I will be able to)

1. Describe Atmospheric Pressure.
2. Describe Bernoulli's Principle.

Warm Up: The air pressure in this room is 100000Pa . The area of the palm of your hand is approximately 180cm^2 . What is the force exerted onto you hand by air? Why don't you feel this force on the palm of your hand?

Assignment: Book Problems Ch 20 Review Questions #8, 10, 12, 17
Think and Explain #5

Atmospheric Pressure

- The weight of the earth's atmosphere exerts pressure onto all things on the earth.
- Air presses onto all parts of our body.
- Because it presses equally everywhere, we do not notice this pressure.
- However, if we were to remove this constant pressure, we would not survive.
- We live on the bottom of an ocean of air.

Fluid Pressure

- Air can be treated as a fluid just like water.
- All fluids want to move from areas of high pressure to areas of low pressure.
- Demos:
 - Balloon/Flask demo
 - Why does the balloon blow up?
 - Where does wind come from?

Demos / Discussion

- Ping pong and straw.
- How is the ball floating?
- Ping pong in sink.
- Why does the ball stick to the water?
- Ball and blower.
- Why does the ball float?
- Cans on rollers.
- Why do the cans go together?
- Why are piers for ships built so that water can pass underneath?

Bernoulli's Principle

- Moving fluid exerts less pressure than non-moving or slower moving fluid.
- Example: A bag getting “sucked” out of a car window.
- The pressure of the moving air outside of the window is less than the pressure inside.
- Air (and the bag) then move from high pressure (inside) to lower pressure (outside).
- What happens to the bag when it is sitting along side of the road and another car goes by?

Bernoulli's Principle of Flight

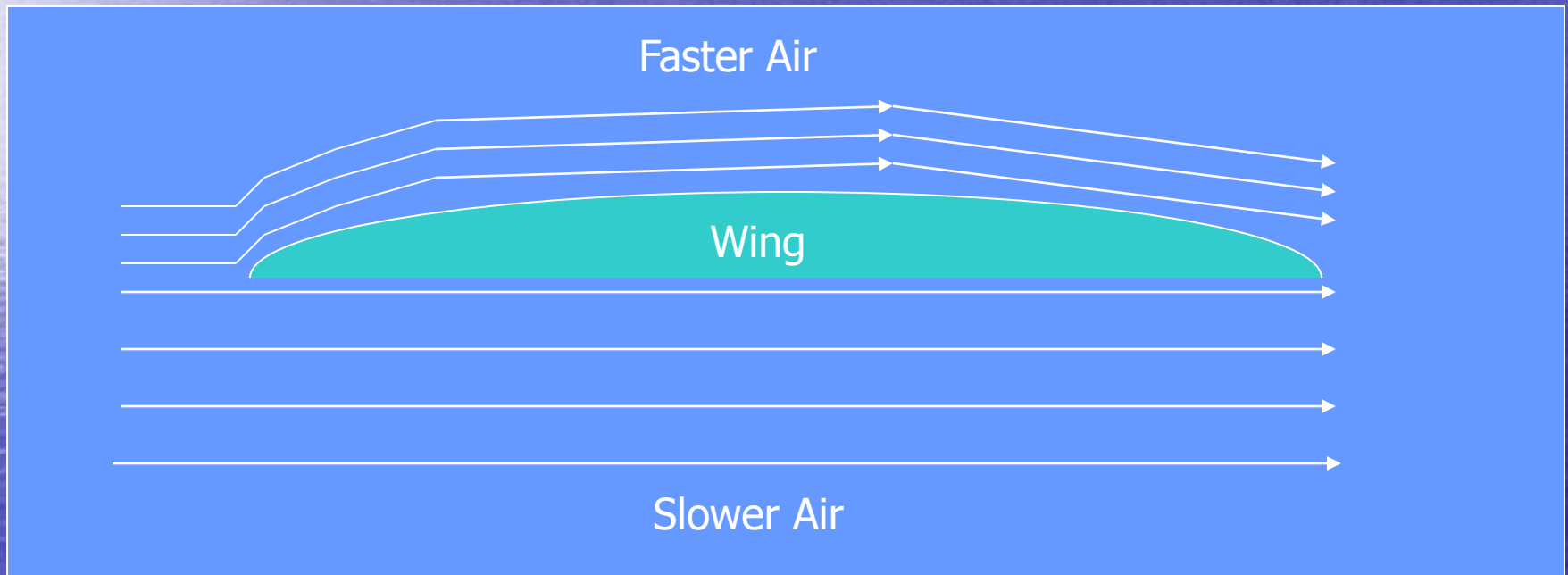
- This concept of pressure was put to use by the Wright brothers.
- Notice the shape of the wing of an aircraft.



- The shape is designed to create less air pressure above the wing than below the wing.

Bernoulli's Principle of Flight

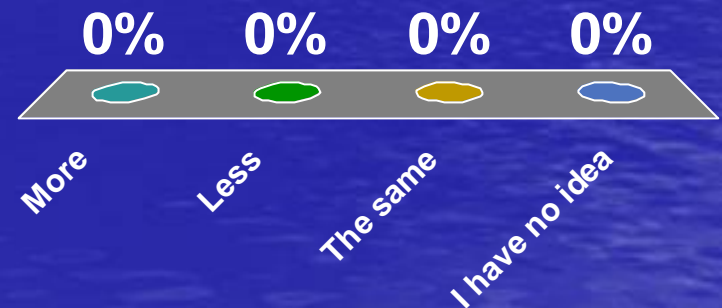
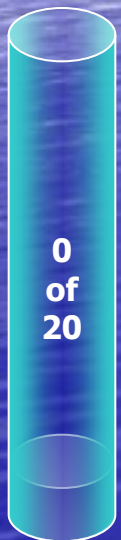
- The air passing the top of the wing will travel a greater distance in the same amount of time as the air passing the bottom of the wing.



- This will create a difference in the velocity of the air, and therefore a difference in pressure.
- This and Newton's Third Law allows flight to occur.

Bernoulli's principle is, faster moving fluid will exert _____ pressure than/as slower moving fluid.

1. More
2. Less
3. The same
4. I have no idea



Lesson #50

1/24/07

Topic: Lab: Atmospheric Pressure

Objectives: (After this class I will be able to)

1. Apply the concept of force per area to calculate the air pressure in the room.

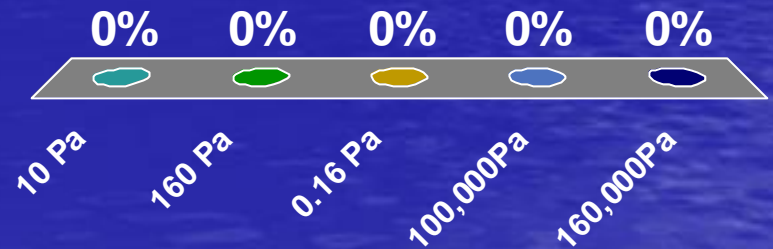
Warm Up: The air in a classroom exerts a force of 40N onto an area of 4cm^2 what is the air pressure in the room?

Lab Task: Use a syringe and known weight to calculate the atmospheric pressure of the classroom.

Assignment: Lab report due tomorrow.

The air in a classroom exerts a force of 40N onto an area of 4cm^2 what is the air pressure in the room?

1. 10 Pa
2. 160 Pa
3. 0.16 Pa
4. 100,000Pa
5. 160,000Pa



Project

- With your partner, write a paragraph or draw a picture on a sheet of paper explaining how an airplane is capable of flying.
- When finished, fold this sheet of paper into an airplane and throw it to the front of the room.

Lesson #51

1/25/07

Topic: Pascal's Principle and Hydraulics

Objectives: (After this class I will be able to)

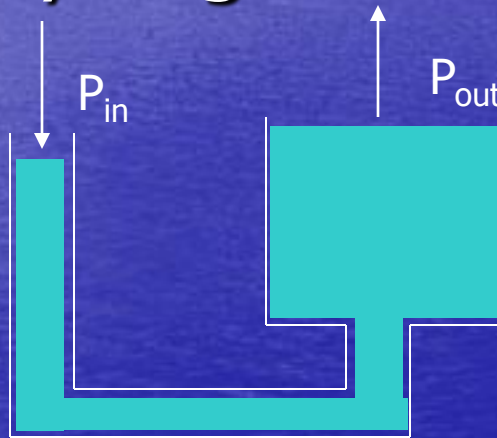
- 1.** Explain and describe Pascal's Principle.

Warm Up: Explain how Bernoulli's Principle with Newton's third law allow flight to occur.

Assignment: Pascal's Principle

Pascal's Principle

- This is the simple idea that the pressure exerted into a system must be the pressure that you get out of a system.
- Example:

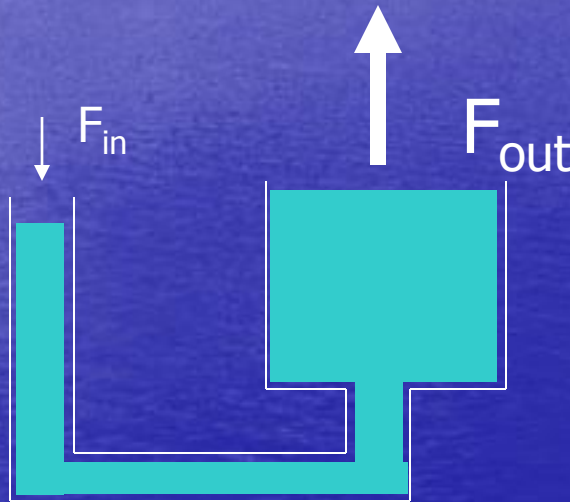


- $P_{in} = P_{out}$
- How is this useful?

Pascal's Principle

- For the small section of tube, there is a small amount of force exerted onto a small area.

$$\frac{F_{in}}{A_{in}} = \frac{F_{out}}{A_{out}}$$



- Because the pressure has to remain the same, if the area of the system gets larger, then the force exerted must get larger as well.

Pascal's Principle

- This is useful because we can now lift heavy objects with only exerting a small amount of force.
- Example:
- In the previous diagram 10N of force is applied over a small area of 8cm^2 . This exerts pressure onto the opposite end of the system where the area expands to 1m^2 .
- What is the output force exerted by this end of the system?

Objectives: (After this class I will be able to)

1. Practice solving physics problems
2. Complete and check Exam 7 Review
3. Plan a tutoring time (if needed)
4. Complete a bonus problem opportunity

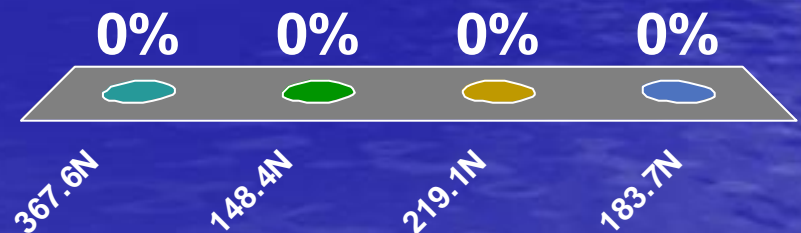
Warm Up: A pump is used to inflate a tire. The initial tire pressure is 210kPa. At the end of the pumping process, the final pressure is 310kPa. If the diameter of the cylinder of the pump is 3cm, what is the average force exerted while pumping?

Assignment: Exam 7 Review due ! Study for Exam 7.

A pump is used to inflate a tire. The initial tire pressure is 210kPa. At the end of the pumping process, the final pressure is 310kPa. If the diameter of the cylinder of the pump is 3cm, what is the average force exerted while pumping?

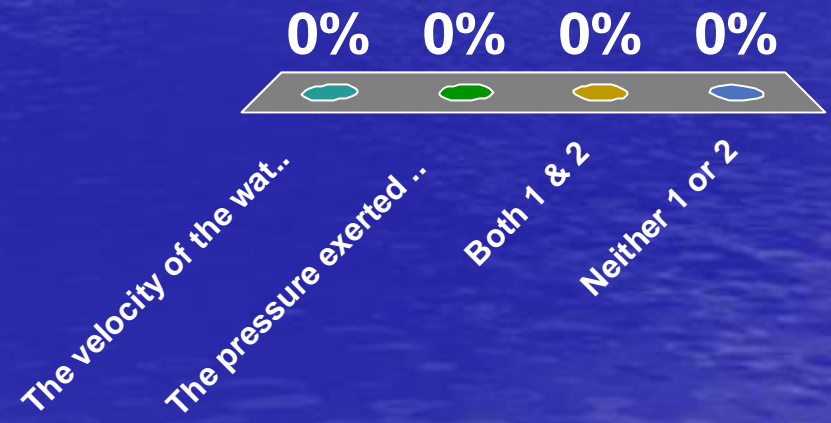
1. 367.6N
2. 148.4N
3. 219.1N
4. 183.7N

0 of 20



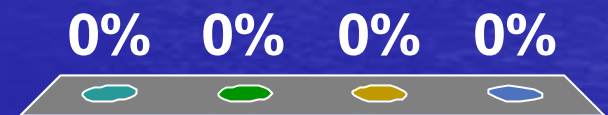
Piers for ships are built on pillars so that water can pass underneath the pier so that ...

1. The velocity of the water on both sides of the ship are relatively the same.
2. The pressure exerted on both sides of the ship are relatively the same.
3. Both 1 & 2
4. Neither 1 or 2



We don't feel the force from the presence of air around us because

1. The force is too weak for us to feel
2. All the forces due to air on one side of our body cancel with the other side.
3. Our bodies do not react or push out against these forces
4. None of the above



The force is too weak f..

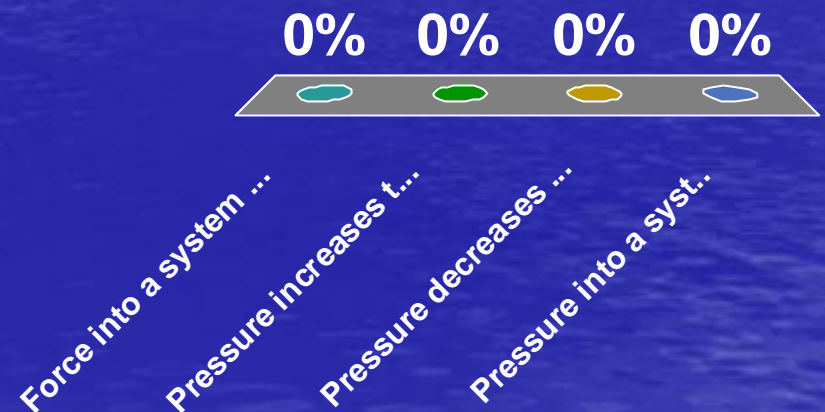
All the forces due to a..

Our bodies do not rea..

None of the above

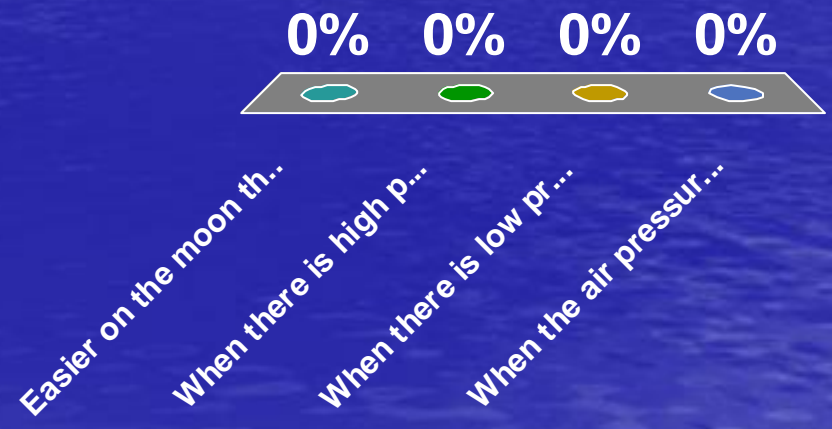
A hydraulic lift works because of Pascal's principle that ...

1. Force into a system equals force out of a system
2. Pressure increases throughout a system
3. Pressure decreases throughout a system
4. Pressure into a system equals pressure out of a system



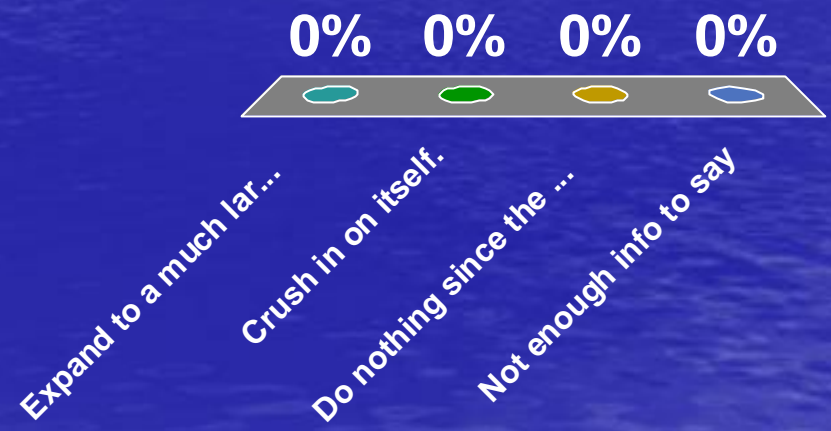
Airplanes remain flying through the air

1. Easier on the moon than on the earth because gravity is less on the moon
2. When there is high pressure below and low pressure above the wings
3. When there is low pressure below and high pressure above the wings
4. When the air pressure above and below the wings are equal.



An empty plastic bottle is sealed so no air can escape. It is then taken up to the top of the earth's atmosphere in a helium balloon. The bottle will ...

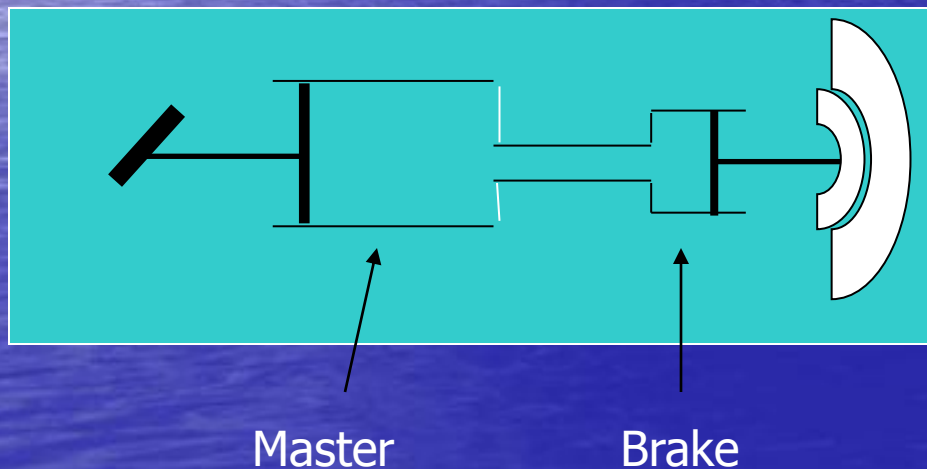
1. Expand to a much larger size and possibly explode.
2. Crush in on itself.
3. Do nothing since the pressure inside and out are equal.
4. Not enough info to say



Approximately how much force
does the atmosphere exert on a
piece of land that is 500m by
400m?

A 50kg girl sits on a 10kg chair so that her body weight is evenly distributed on the legs of the chair. Assume that each leg makes contact with the floor over a circular area with a radius of 2cm. What is the pressure exerted on the floor by each leg individually?

- A hydraulic brake system is shown below. The area of the piston in the master cylinder is 8.4cm^2 , and the area of the piston in the brake cylinder is 2.75cm^2 . The coefficient of friction (μ) between the brake shoe and the wheel drum is **0.5**. Determine the **friction force** between the brake shoe and the wheel drum when a force of 55N is exerted on the pedal.



Bonus

- A paintball gun fires 2.5g paintballs 1.5cm in diameter through the use of air pressure. If the pressure in the canister of compressed CO-2 in the gun is 250000Pa, how fast is the paintball moving when it reaches the end of the 45cm long barrel? (2pts)
- What is the maximum range of this gun? (3pts)